School of Chemistry
Faculty of Science
University of the Punjab, Lahore
Course Outline

BS Chemistry Semester-VI					
Programme	**BS Chemistry**	**Course Code**	**Chem-348**	**Credit Hours**	**2**
Course Title	**Analytical Separation Tools-I**		**Course Type**	**Major (Elective)**	

Course Introduction

The course will enable the students to understand the use and mechanism of separation techniques (solvent extraction and solid phase extraction) and their application in sample preparation.

Solvent extraction:

Basic principle of solvent extraction, distribution coefficient, distribution ratio, percent extracted, choice of solvent, solvent extraction of metals, multiple batch extractions, countercurrent distribution, continuous solvent extraction, applications

Solid-phase extraction:

Basic principle, mechanism of separation, sample characteristics, properties of sorbents, elution process, applications in sample preparation, introduction to solid phase micro extraction (spme), mechanism of separation, applications in sample preparation

Electrophoresis:

Basic principle, types of electrophoresis, analytical protocol, theory, instrumentation and types of capillary electrophoresis and gel electrophoresis, applications of various types of electrophoresis

Learning Outcomes

On the completion of the course, the students will:

1. Explain the basic principles and key concepts of solvent extraction.
2. Apply solvent extraction techniques in various industrial and laboratory settings.
3. Apply solid-phase extraction techniques in various industrial and laboratory settings.
4. Understand the theory, instrumentation, and applications of capillary and gel electrophoresis.
5. Apply electrophoresis techniques in various industrial and laboratory settings.

Course Content		Assignments/Readings
Week 1	Introduction to Solvent Extraction Basic principles of solvent extraction Key concepts: Distribution Coefficient, Distribution Ratio, Percent Extracted	Collect the material from recommended books and read as per lecture
Week 2	Choice of Solvent Factors affecting the choice of solvent Practical applications in solvent extraction of metals	Read and understand the lecture and make possible question for discussion
Week 3	Multiple Batch Extractions Theory and practice of multiple batch extractions Practical examples and calculations	Read and understand the lecture and make possible question for discussion
Week 4	Countercurrent Distribution Principles and applications of countercurrent	Read and understand the lecture and make possible

	distribution Practical examples and case studies	question for discussion
Week 5	Continuous Solvent Extraction Mechanisms of continuous solvent extraction Practical applications and setup	Read and understand the lecture and make possible question for discussion
Week 6	Applications of Solvent Extraction Industrial and laboratory applications Case studies and examples	Read and understand the lecture and make possible question for discussion
Week 7	Review and Practice	Read and understand the lecture and make possible question for discussion
Week 8	Mid-term assessment	
Week 9	Introduction to Solid-Phase Extraction Basic principles and mechanisms of separation Sample characteristics and properties of sorbents	Read and understand the lecture and make possible question for discussion
Week 10	Elution Process in Solid-Phase Extraction Detailed study of the elution process Practical applications in sample preparation	Read and understand the lecture and make possible question for discussion
Week 11	Introduction to Solid Phase Micro Extraction (SPME) Principles and mechanisms of SPME Practical applications in sample preparation	Read and understand the lecture and make possible question for discussion
Week 12	Applications of Solid-Phase Extraction and SPME Industrial and laboratory applications Case studies and examples	Read and understand the lecture and make possible question for discussion
Week 13	Introduction to Electrophoresis Basic principles and types of electrophoresis Overview of analytical protocols	Read and understand the lecture and make possible question for discussion
Week 14	Capillary Electrophoresis Theory and instrumentation of capillary electrophoresis Applications and practical examples	Read and understand the lecture and make possible question for discussion
Week 15	Gel Electrophoresis Theory and instrumentation of gel electrophoresis Applications and practical examples	Read and understand the lecture and make possible question for discussion
Week 16	Final assessment	

Textbooks and Reading Material

1. Vogels, text book of Quantitative chemical analysis by J. Mendham, R.C.Denny, J. D. Barnes, MJ KTHomas, Pearson education Ltd.
2. Solvent Extraction by Gorge H. & Morrison Hener, John Wiley and sons, London, N.Y.
3. Analytical Chemistry by G.D. Christian.
4. Advances in electrophoresis by Andrea Chrmambach, Wiiley- VCH.

Teaching Learning Strategies
1. Lecturing using white/black board/Multimedia 2. Written Assignments 3. Class activities and discussion 4. Quiz about last lecture **5.** Presentations
Assignments: Types and Number with Calendar
Assignments, quiz, Tasks, Presentation etc.
Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing, etc.

BS Chemistry Semester-VI					
Programme	**BS Chemistry**	**Course Code**	**Chem-349**	**Credit Hours**	**1**
Course Title	**Analytical Separation Tools (Lab-I)**		**Course Type**	**Major (Elective)**	

Course Introduction

This course will help the students in performing the experiments for the understanding of solvent extraction and solid phase extraction. They will learn the sample preparation for the specific analysis.
Determination of Distribution ratio of benzoic acid
Determination of distribution ratio of iodine
Solvent extraction of chlorophyll from tree leaves
Solvent extraction of Nickle-DMG complex from aqueous solution using chloroform
Determination of extraction efficiency for benzoic acid from aqueous solution
Extraction of methyl red from aqueous solutions using ethyl acetate
Separation of p-toluic acid and benzil using ether

Learning Outcomes

On the completion of the course, the students will:

1. Familiarize with the lab equipment and materials used in solvent extraction.
2. Understand the principles of equilibrium distribution in solvent extraction.
3. Gain insight into the factors affecting solute distribution.

Course Content		Assignments/Readings
Week 1	Introduction and Lab Safety Training	Collect the material from recommended books and perform practical
Week 2	Determination of Distribution Ratio of Benzoic Acid	Collect the material from recommended books and perform practical
Week 3	Determination of Distribution Ratio of Iodine	Collect the material from recommended books and perform practical
Week 4	Solvent Extraction of Chlorophyll from Tree Leaves	Collect the material from recommended books and perform practical
Week 5	Solvent Extraction of Nickel-DMG Complex from Aqueous Solution Using Chloroform	Collect the material from recommended books and perform practical
Week 6	Determination of Extraction Efficiency for Benzoic Acid from Aqueous Solution	Collect the material from recommended books and perform practical
Week 7	Review and Practice	Collect the material from recommended books and perform practical
Week 8	Mid-term assessment	
Week 9	Extraction of Methyl Red from Aqueous Solutions Using Ethyl Acetate	Collect the material from recommended books and perform practical

Week 10	Separation of p-Toluic Acid and Benzil Using Ether	Collect the material from recommended books and perform practical
Week 11	Independent Projects and Research Proposals	Collect the material from recommended books and perform practical
Week 12	Independent Projects and Research Proposals	Collect the material from recommended books and perform practical
Week 13	Independent Projects and Research Proposals	Collect the material from recommended books and perform practical
Week 14	Independent Projects and Research Proposals	Collect the material from recommended books and perform practical
Week 15	Review and Final Preparations	Collect the material from recommended books and perform practical
Week 16	Final assessment	

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Teaching Learning Strategies

Lecturing using white/black board/Multimedia

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